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# The Gray Market in Nuclear Materials: A Growing Proliferation Danger

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An Intelligence Assessment

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GI 84-10118
July 1984
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**An Intelligence Assessment**

This paper was prepared by Office of Global Issues. Comments and queries are welcome and may be directed to the Chief, International Security Issues Division, OGI,

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# The Gray Market in Nuclear Materials: A Growing Proliferation Danger

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## Key Judgments

*Information available as of 11 June 1984 was used in this report.*

Loopholes in export control regulations of nuclear-supplier states contribute to the growth of a gray market in nuclear materials and technology and threaten the integrity of the international nonproliferation regime. It is a growing problem and is likely to get worse.

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A handful of adept West European brokers exploit this situation to sell nuclear-related materials, equipment, and technology used in nuclear weapons research to countries of proliferation concern, including Argentina, Brazil, India, Iraq, Pakistan, and South Africa. Brokers manipulate export controls through a variety of techniques to get nuclear-related materials to the purchasers, including:

- Creation of front organizations.
- Falsification of end-use statements.
- Alteration of information listed on export applications.
- Transshipment through third countries with lax export control.

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The use of brokers enables countries with nuclear ambitions to disguise their intentions, avoid safeguards requirements, and, in some instances, obtain sensitive materials that otherwise would be denied to them. The nuclear industry in Western Europe finds brokered deals attractive because such deals provide a buffer that permits sellers to market aggressively to countries of proliferation concern while protecting the firms and their governments from the political consequences of their actions.

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The most effective way to curb the activities of international brokers is to limit their source of supply—primarily the West European nuclear industry. West European governments will have to give higher priority to the proliferation risks posed by gray market exports than to short-term domestic commercial benefits if brokers' activities are to be controlled.

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# The Gray Market in Nuclear Materials: A Growing Proliferation Danger

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## Introduction

The use of intermediaries or brokers enables countries of proliferation concern to acquire sub rosa sensitive nuclear-related technology. Argentina, Brazil, India, Iraq, Pakistan, and South Africa, for example, have used brokers to obtain nuclear-related materials without international safeguards or to acquire equipment and technology otherwise denied to them. The existing international nonproliferation regime, designed to control government-to-government sales of sensitive nuclear materials, has proved ineffective in curbing the emerging international gray market. Many gray market activities technically are legal under national export laws but violate the spirit of a country's nonproliferation policies and/or international agreements.

## Emergence of the Gray Nuclear Market

Gaps in the coverage and effectiveness of the global nonproliferation regime have facilitated the development of a gray market in nuclear materials. The regime prohibits government sales of certain sensitive nuclear materials and technologies to nonnuclear weapons states in order to discourage the use of nuclear technology for military purposes. It operated reasonably well as long as the suppliers of nuclear materials were few and shared a common view on the types of materials and assistance requiring regulation. Changes over the past decade, however, have undermined the regime's effectiveness, and this degradation is likely to accelerate:

- The emergence of new suppliers of nuclear materials, motivated by political and commercial interests, has effectively broken the Western monopoly on nuclear exports. Argentina, Brazil, China, India, Israel, Pakistan, and South Africa have begun to sell or barter their nuclear expertise to other countries with nuclear ambitions.

- The Western suppliers' consensus on a philosophy of export regulation has eroded in the face of economic competition. Retrenchment in the nuclear power industry in the last seven years has accelerated the level of competition among traditional suppliers—the West Europeans, Canada, and the United States—for what few sales opportunities exist.

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The subsequent entry of new suppliers who are willing to sell technology, materials, and equipment without international safeguards further intensifies competition for sales. US diplomatic sources report that the resolve of some Western exporting countries to regulate tightly sensitive exports appears to be weakening as a result.

- Countries of proliferation concern have grown more sophisticated in circumventing established nonproliferation guidelines. Pakistan, for example, has become more adept in its clandestine procurements. Pakistan not only knows what technologies it needs but also is knowledgeable enough to break these down into component parts, facilitating their purchase without raising suspicions.

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Venturesome entrepreneurs and buyers can operate successfully by exploiting ambiguous domestic export control laws and less-than-comprehensive international regulations. The frequency with which the countries of near-term proliferation concern resort to brokered transactions has increased notably in the last five years.

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Although the volume and monetary value of gray market transfers is small—in comparison to the enormous sums involved in building a nuclear power plant—we judge that the materials procured through the gray market are important to the success of nuclear programs like that of Pakistan.

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***The Gray Nuclear Materials Market***

*In the mid-1970s, the major Western nuclear-supplier states agreed to specific lists of items requiring safeguards as a condition of transfer. These items include: more than 50 grams per year of plutonium with an isotopic concentration of $Pu^{239}$ exceeding 80 percent, more than 500 kilograms of natural uranium, more than 1,000 kilograms of depleted uranium, and more than 1,000 kilograms of thorium. Also included are nuclear reactor component parts specially designed for the processing or the production of fissile material. Certain other categories of nuclear-related materials are also regulated, such as deuterium, nuclear-grade graphite, items for fuel fabrication and reprocessing plants, and isotope separation plant equipment.*

*Negotiations among the major supplier states to expand these lists continue. US State Department reporting indicates that important progress on adding specific equipment used in reprocessing and uranium enrichment is under way or nearing completion. Despite these efforts, a massive array of technologies that have both nuclear and nonnuclear application are traded freely and do not require safeguards controls. It is these dual-use technologies that brokers generally buy and sell, including the following equipment and materials.*

***Equipment***

*Remote manipulators, spectrometers, numerically controlled lathes, sintering furnaces, high-temperature ovens, gas chromatograph equipment, high-frequency generators, neutron pulse generators, compressors, coaxial cable, centrifuge components, radioactive waste evaporation equipment, gamma counters, helium leak detectors, glove box equipment, ring magnets, high-frequency motors, welding machines, liquid nitrogen plants, air filtration systems, computers, power supply units, gas analyzers, bellows, electron-welding machines, high-speed cameras, hot isostatic presses, flash X-ray cameras, valves, mixer-settlers, and coordinate measuring machines.*

***Materials***

*Zirconium, beryllium, bismuth, cadmium, calcium metal, argon, fluorine, high-tensile aluminum, depleted uranium, strontium, deuterium, graphite, and nuclear-grade steels.*

**Operation of the Gray Market**

***Buyer Incentives.*** The gray market provides a readily available source of assistance to developing countries with nuclear ambitions. According to US State Department reporting [redacted] 25X1
[redacted] buyers turn to the gray market because 25X1
it may provide:

- An unregulated source of nuclear material for a country that wants to acquire unsafeguarded materials for its indigenous program. Materials obtained through the gray market can be used in a nation's indigenous nuclear programs without incurring the legal obligation to permit international inspection of those facilities. [redacted] 25X1
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- A convenient way for a country to disguise its nuclear intentions and avoid the political and diplomatic problems of dealing formally government to government. The gray market provides a way for countries like South Africa and Israel to deflect international attention from procurement activities that, if made public, could be embarrassing to the supplier's government. 25X1

- The only way to obtain some nuclear materials. [redacted] 25X1
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***Seller Incentives.*** From the seller's perspective, the gray market has emerged as an attractive and increasingly popular way of selling nuclear-related products. For the manufacturing companies of nuclear-related items, it has become easier and safer to sell to a West European broker than directly to a country of known proliferation concern, [redacted] 25X1
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Between 1979 and 1982, several West German and Swiss firms that had been supplying Pakistan directly with sensitive nuclear-related technologies for uranium enrichment were bombed and their employees 25X1



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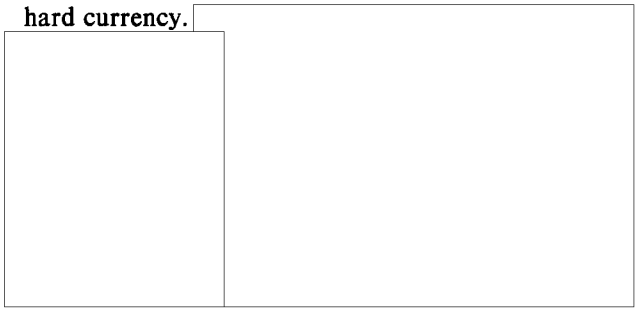
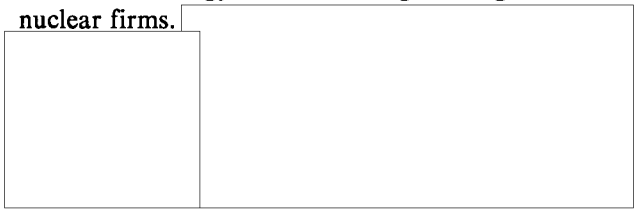
received death threats—activities possibly carried out on behalf of the Governments of Israel or India. By switching from direct marketing, these firms insulate themselves against the international harassment that direct sales to Pakistan and other countries of proliferation concern provoke.

Nuclear firms in West Germany, Italy, Switzerland, Belgium, Luxembourg, and the Netherlands also use brokers to sell products whose exporting directly to a buyer of proliferation concern is restricted by international agreements. Selling through brokers, who legally reside in Western Europe, allows the firm to plausibly deny any knowledge of the ultimate destination of its nuclear products. The governments of countries like Italy, West Germany, Switzerland, Belgium, and the Netherlands—subject to substantial commercial pressures to export—often take a relaxed attitude toward brokers' activities, according to diplomatic reporting. Not only can the government contend that it permitted export only to another Western country but also that the transactions contribute to the economic well-being of nuclear firms.

Most companies use the gray market to avoid unfavorable publicity or political pressure on their sales activities, but some companies and governments are attracted by the high profit margin on gray sales without international safeguards. China, for example, sells nuclear materials on the gray market to earn hard currency.



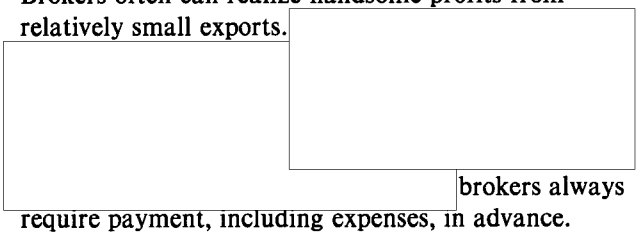
Companies make the transition from direct marketing to intermediaries quite easily because the brokers of nuclear technology often have longstanding ties with nuclear firms.



***Role of the Broker.*** Brokers of nuclear materials facilitate transfers of equipment, technology, and even assistance by matching buyers with sellers and arranging for payment and delivery. The job of a broker of nuclear technology is, in principle, quite similar to that of gray marketeers of conventional arms or computer technology, and he faces many of the same problems: 25X1

- The broker may set up dummy companies to expedite transfers of items whose export legally is prohibited.
- The broker may falsify documentation for the transfer or otherwise "grease the skids" to avoid customs agents.
- The broker provides access to materials that are hard to obtain. 25X1

Brokers often can realize handsome profits from relatively small exports. 25X1



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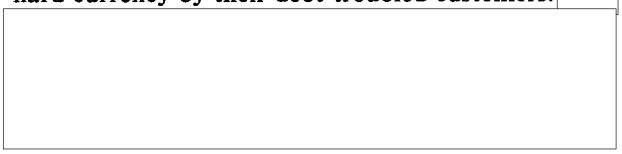
brokers always require payment, including expenses, in advance. Governments and firms who deal directly have faced delayed payments and even have had to renegotiate credit terms on safeguarded, aboveboard nuclear contracts, but brokers have no problems being paid in hard currency by their debt-troubled customers. 25X1



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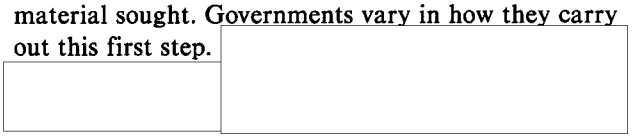
**Anatomy of a Gray Market Transaction**

enabled us to develop a profile common to most gray market nuclear transactions. First, the government of a country of proliferation concern either directly or through a cover firm obtains price quotations for the nuclear material sought. Governments vary in how they carry out this first step. 25X1



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***Problems of Tracing Gray Nuclear Market Transfers***

*There are a number of problems associated with identifying and documenting gray nuclear market transfers. Even when a transaction is technically legal—that is, without the added problem of falsified information—the many steps in completing a sale and the almost infinite number of possible institutions involved (banks, private companies, shipping firms, and holding companies) make it easy to disguise a transaction as part of the normal world of day-to-day transnational business activities.*

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*There are hundreds, if not thousands, of firms that may be approached in deals that can stretch out over a period of many months.*

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*West Germany alone has more than 700 firms that export dual-use nuclear materials. A systematic effort to identify gray market transactions presents some major obstacles, particularly in tracing the payments and deliveries. For example, a line of credit may be opened at a West European bank in the name of a known broker, but national laws generally prohibit access to this information. The line of credit may remain untouched for a year, during which time several hundred other lines of credit are opened at other institutions in the same name.*

In the second step, a procurement official may go directly to a West European nuclear firm or may commission a broker to arrange a nuclear purchase. The more sensitive the acquisition, the more likely it is that a broker will be used to disguise the sale. A line of credit at a bank is subsequently opened in the broker's name, and delivery of the goods is arranged. The four most common methods of making gray market deliveries are:

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- Export of nuclear equipment as component parts when the components appear innocuous and may not require an end-use declaration under national export laws.

- Falsification of end-use statements if delivery is made directly to a country of obvious proliferation concern, such as Pakistan.

- Transshipment of the nuclear goods to a third country with lax export control laws.

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- Alteration of information listed on an export application to make it appear that the item is not subject to export restrictions. With many dual-use nuclear technologies, the difference between a restricted and nonrestricted item may depend only on the size of its component parts—for example, the diameter of a valve, the thickness of a blade, or the capacity of a compressor.

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**The Role of Government Export Review**

Loose implementation of national export control regulations facilitate brokers' activities. The dual-use application of much of the technology—the myriad of compressors, pumps, valves, evaporators, condensers, and materials such as graphite and zirconium that have both nuclear and nonnuclear applications—makes even the most vigorous attempts at regulation difficult. Compounding this problem are significant differences among Western nuclear suppliers about how to regulate nuclear technology transfers. We believe that knowledge of the differences in export laws and practices largely explains why the brokers of nuclear proliferation technology have been able to operate effectively out of West European countries.

The attitude that the governments of Western Europe's leading suppliers take regarding nuclear export regulation derives, according to US Embassy reporting, from four principal elements:

- Adherence to the strictest letter of international agreements. The application of controls and international safeguards as a condition for transferring nuclear materials, equipment, and technology has been the hallmark of international nuclear commerce since the 1950s. The 121 countries now party to the Nuclear Non-Proliferation Treaty (NPT) have agreed to regulate some nuclear exports to prevent the use of nuclear materials and technology for military purposes. The IAEA administers a system of safeguards and international inspections, as required by the NPT or other agreements with non-NPT countries, to ensure the peaceful uses of nuclear energy.

- Encouragement of exports of nuclear technologies not specifically in violation of international agreements for domestic economic reasons.

- Recognition by countries' foreign policy leaders that international agreements, as currently formulated, omit many potentially sensitive items that could contribute to nuclear weapons research and development.

- Realization that the proliferation consequences of nuclear exports do not routinely raise domestic political problems within most West European nuclear supplier states.

This attitude allows brokers to conduct their business through lax export administration procedures. It creates an environment that facilitates gray nuclear market operations involving brokers who scatter their small companies in several West European countries. West Germany, Switzerland, and the Netherlands have been particularly attractive havens for international brokers. 25X1

No West European country adheres to the restrictive US nuclear export control system which makes a determination of the end use of an item a necessary part of the export licensing process. West European countries adhere to their legal obligations under the NPT and IAEA,[1] which obligate them not to assist any country in developing nuclear weapons but generally do not control the large group of dual-use nuclear materials, according to diplomatic reporting. Furthermore, in contrast to the United States, West European nuclear export laws contain no catchall provision requiring control of materials when the export firm knows or has reason to believe the item will be used for nuclear explosive activities. 25X1 25X1

West European governments consequently do not feel obligated to consult with fellow suppliers about piecemeal procurements of nuclear technology in component parts, according to US Embassy reporting over the last five years. Nor do they request safeguards assurances from recipient countries unless the item exported is regulated. Although the US State Department reports that important progress has been made on upgrading the lists of sensitive items to include technologies and equipment used in the construction of centrifuge uranium enrichment plants, a vast array of other dual-use items—ranging from equipment useful in chemical reprocessing facilities to zirconium for cladding nuclear fuel—remain available for routine export. 25X1

***West Germany.*** Companies in West Germany have been the most continuous supplier of nuclear-related technology, equipment, and assistance to the Third World. West Germany's large nuclear firms have concluded profitable nuclear power program contracts

[1] France, although not a member of the NPT, nevertheless adheres to the principles of the NPT exporters' guidelines. 25X1

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in Iran and Brazil. They also have been involved in a number of potentially sensitive transfers to countries of proliferation concern, including:

- Assistance to Brazil for a laboratory-scale reprocessing facility without safeguards, apparently as a "sweetener" in concluding the 1975 accord to construct eight nuclear power reactors and to provide ancillary fuel cycle technology.

- Technical assistance and equipment to Argentina for an unsafeguarded pilot reprocessing facility, scheduled for completion in 1985, that will be capable of separating 15 to 20 kilograms of plutonium annually.

We believe West Germany's lax export review process creates a favorable operating environment for brokers. The export review process is conducted by an understaffed Federal Office for Trade and Industry within the Economics Ministry, according to diplomatic reporting from Bonn. The Ministry also has a mandate to control and promote exports. In politically sensitive cases, the Foreign Ministry may be asked to make a nonbinding recommendation on a particular export. The Finance Ministry supervises the actual enforcement at exit ports. Under West German export law, end-user statements are required of all export license applications. These require only that the company importing a product be listed, unlike the US practice which requires an end-use statement. In practice, Bonn takes a legalistic view of regulation; as a result, as long as an item is not on an export control list, export is automatically approved. In response to political outcries over the agreement to transfer a complete fuel cycle to Brazil, West Germany in the mid-1970s established a cabinet-level nuclear council, chaired by the Chancellor, to more closely scrutinize potentially sensitive nuclear technology transfers of proliferation concern. Despite this additional layer of formal review, US Embassy reporting indicates that Bonn still does not exercise vigorous control over nuclear exports.

***Switzerland.*** Swiss nuclear firms can manufacture major parts of the nuclear fuel cycle. Unlike West Germany, however, Switzerland has never had a large domestic market for this expertise, so the Swiss nuclear industry traditionally has been export oriented. This has given Swiss marketing agents the opportunity to establish close ties with several countries of proliferation concern—notably Argentina, Libya, Iraq, Pakistan, and South Africa.

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Swiss Government policy on nuclear exports can be characterized as rigid adherence to the letter of the law and equal resistance to most initiatives in support of the spirit of nonproliferation, according to US diplomatic reporting. Its international reputation for discretion toward all business activities within its borders also facilitates brokers' activities. Two provisos of Swiss export policies specifically aid brokers:

- The law requires only that export applications list country of destination, not end user or end use. This makes third-party transfers very common and largely explains why Switzerland is among the easiest countries from which to export dual-use nuclear technologies.

- Official government policy holds that, as long as an item is not on the trigger lists of sensitive nuclear-related materials, its export is encouraged. According to public pronouncements of the Foreign Commerce Office, export priority is to be placed on trade to the industrializing and oil-producing developing countries.

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Bern's toleration of controversial nuclear exports does have occasional limits. Following a high-level US demarche in 1980, for example, the Swiss Government cracked down on the export practices of three small Swiss firms that had been providing a vast array of nuclear-related components for uranium enrichment and spent fuel reprocessing to Pakistan from 1978 to 1980. According to US State Department reporting, the marketing agents of the Swiss firms—almost certainly knowingly—cooperated with Pakistan in using intermediaries and front organizations at both ends of the supply route. Swiss Government

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intervention caused brokers to be more cautious but has not halted their activities.

***The Netherlands.*** Like its West European neighbors, the Netherlands adheres to the strict letter of its international agreements, including the NPT and the IAEA's safeguards requirements. The US Embassy reports that the Economics Ministry, which is in charge of export licensing, takes a relaxed attitude toward all nonproscribed and dual-use exports because foreign trade is a national priority. Dutch Economics Ministry officials furthermore have told their US counterparts that they do not believe export controls on nuclear materials are a particularly effective tool for nonproliferation because they are so easily circumvented.

A Dutch parlimentary resolution in 1980 called for better coordination between the Economic and Foreign Ministries on nuclear exports. A special coordinator for nonproliferation was established following domestic controversy over a then-pending decision whether to permit export of enriched uranium to Brazil, a non-NPT state. The Dutch Government created an interagency group in 1981 to examine tightening legal controls on nuclear exports modeled along the lines of US legislation. After two years of study, the group recommended against stricter regulations, arguing that ambiguities in international law and possible conflicts with Common Market regulations precluded tighter nuclear export controls

In politically sensitive cases, The Hague may intervene to halt a particular export, according to the US Embassy. the Government of the Netherlands knew about and tried to stop an order of possible nuclear weapons components being supplied by a Dutch company to Pakistan. In late 1983 the government successfully convicted in absentia the head of Pakistan's secret uranium enrichment facility, A. Q. Khan, for stealing classified information about Dutch uranium enrichment technology in the mid-1970s. The above cases notwithstanding, the Dutch Government continues to encourage routine exports of dual-use nuclear materials.

**Prospects**

We believe that sub rosa procurements of nuclear-related materials are likely to continue and even to grow. As long as domestic commercial pressures to export dual-use nuclear materials, equipment, and technology remain high, West European governments are unlikely to judge the proliferation impact of gray market activities as more important than the economic benefits to be gained from the exports 25X1 25X1

The emergence of gray nuclear commerce creates obstacles to global efforts to contain the spread of nuclear weapons because it diminishes incentive for cooperation among supplier countries. We believe that the motivation for nuclear supplier states to crack down on the flow of potentially sensitive items from their countries continues to weaken as brokers achieve more and more success and their business expands. West European supplier states, according to diplomatic reporting, argue that curbing dual-use exports would have no significant impact on halting proliferation because the majority of transfers involve third parties as the source of the material, as a transshipment point, or as brokers. 25X1 25X1

The continued existence of nuclear export loopholes undermines confidence in the nonproliferation regime, but more significantly we believe that the NPT increasingly may be perceived as rewarding nonsignatories of the treaty. Countries that have refused to sign the NPT and to place their nuclear programs under international safeguards appear to be able to import at least as much—and often more—sensitive nuclear technology as member nations. 25X1 25X1

The most effective way to curb the activities of international brokers is to limit their source of supply—the Western nuclear industry. This requires concrete intelligence showing that a nuclear product sold apparently innocently to a West European businessman really starts the chain of a brokered transaction—from the procurement order laundered through a broker and his auxiliary agents to a front company for a secret nuclear facility. In the face of firm evidence of brokers' activities, West European governments would find it more difficult to permit short-term commercial gain to outweigh clear-cut proliferation danger. 25X1 25X1 25X1 25X1



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